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Final Technical Report

Study of the Interaction of the Solar Wind with Neptune

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Summary of Research

The proposed research consisted of an examination of the ULF waves both in the magnetosphere and in the region upstream of the bow shock on magnetic field lines attached to the bow shock. We attempted vigorously to pursue both objectives. We examined all the magnetometer data in the Neptune magnetosphere but found little evidence for ULF waves. This was reported at the 7th Scientific Assembly of IAGA (Paper 2.3). We were less successful in obtaining the ULF wave data external to the magnetosphere. These data were not submitted to the PDS until after the grant had expired. The data are presently in the possession of the PDS but are not publically available, or even announced.

In order to achieve the objectives of the grant we examined equivalent data at Saturn for which the PDS had the necessary data. We reported on the Saturn waves in a series of papers at meetings (2.1, 2.2, 2.4, 2.5, 2.6). We showed that two ion driven modes were present: probably associated with leakage ions and reflected ions at the bow shock. We also examined the whistler mode waves whose 1AU equivalent occur at about 1 Hz in the spacecraft frame. Surprisingly at the shock these waves have about the same absolute amplitude as the waves at Earth, Venus and Mercury. These results were published in a pair of papers in the Journal of Geophysical Research (1.1, 1.2) and reviewed in paper (1.3) in the context of earlier research. Finally a new analysis technique was developed based on the experience gained in studying these waves (1.4).

1. Papers published in Books and Journals

- 1.1 D. S. Orłowski, C. T. Russell, and R. P. Lepping, Wave phenomena in the upstream region of Saturn, J. Geophys. Res., 97, 19,187-19,199, 1992.
- 1.2 D. S. Orłowski, C. T. Russell, D. Krauss-Varban, and N. Omidi, Growing "Alfvenic" modes in the upstream region of Saturn, J. Geophys. Res., 99, 19-25, 1994.
- 1.3 C. T. Russell, Planetary upstream waves, in Solar Wind Sources of Magnetospheric Ultra-Low-Frequency Waves, 75-86, American Geophysical Union, 1994.
- 1.4 D. S. Orłowski, G. Le, C. T. Russell, D. Krauss-Varban and N. Omidi, Experimental studies of the properties of "simulated" upstream turbulence using a statistical multipoint method, in Adv. Space Res., 15, (8/9)117 - (8/9)123, 1995.

2. Papers presented at Meetings

- 2.1 D. S. Orłowski, G. Le, C. T. Russell, D. Krauss-Varban and N. Omidi, Damping characteristic of upstream whistlers, presented at Spring National AGU Meeting, (abstract) EOS 74(16), Spring Meeting Suppl., 248, 1993.
- 2.2 D. S. Orłowski, G. Le, C. T. Russell, D. Krauss-Varban and N. Omidi, Damping properties of upstream whistlers, presented at 7th Scientific Assembly of IAGA, Buenos Aires, August 1993.
- 2.3 C. T. Russell, Hydromagnetic waves in other planetary magnetospheres, presented at 7th Scientific Assembly of IAGA, Buenos Aires, August, 1993.
- 2.4 D. S. Orłowski and C. T. Russell, Comparison of properties of upstream whistlers at different planets, presented at the 30th COSPAR Scientific Assembly, Hamburg, July 1994.
- 2.5 D. S. Orłowski, C. T. Russell, D. Krauss-Varban and N. Omidi, Comparative analysis of propagation modes of ULF upstream waves at inner and outer planets, presented at the 30th COSPAR Scientific Assembly, Hamburg, July 1994.
- 2.6 D. S. Orłowski and C. T. Russell, Comparison of properties of upstream whistlers at different planets, presented at the Fall Annual AGU meeting (abstract) EOS, 75(44) Supplement, 533, 1994.